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**TITLE: Vertical Drop Test of a Shorts 3-30 Airplane**

A Short Brothers PLC, Model SD 3-30, airplane was subjected to a vertical impact drop test at the Federal Aviation Administration (FAA) William J. Hughes Technical Center, Atlantic City International Airport, New Jersey. The objective of the test was to determine the impact response of the fuselage, seat tracks, seats and anthropomorphic test dummies on a high wing, commuter type, airplane. The test was conducted to simulate the vertical velocity component of a severe, but survivable, crash impact. A final impact velocity of 30 feet per second was therefore selected. The airplane was configured in a typical, maximum gross weight, flight condition, including seats, simulated occupants, fuel, and cargo. The data collected in this test will supplement the existing certification basis for improved seat and restraint systems for commuter category airplanes as defined in Title 14 of the Code of Federal Regulations (CFR) Part 23 (19,000 pounds gross weight limit).

The Shorts 3-30 is a twin turboprop, 30 passenger regional transport airplane. It is 58 feet long and has a wing span of 75 feet. The total test weight of the airplane was 21,210 pounds. The internal seating arrangement consisted of pilot and copilot seats, eight rows of standard passenger seats, and two nonstandard seats mounted in the aisle. Twenty-one of the 28 seats were occupied by mannequins; the remaining seven seats were occupied by instrumented anthropomorphic test dummies.

The Shorts 3-30 fuel system is unique insofar as the two fuel tanks are located on top of the fuselage as opposed to the more conventional location in the wings. During the drop test, massive fuel spills into the passenger compartment occurred. A more detailed analysis of the fuel spillage was therefore warranted due to the increased potential of injury to the passengers with this fuel system configuration.

The stiff structure of the airplane allowed for only small amounts of airframe crushing. As a result the fuselage experiencing high  $G_{\max}$  levels of approximately 90 g's with a impact pulse duration of 15 ms. The stiff structure also prevented fuselage crushing which allowed the airplane to maintain a protective shell.

The seat tracks remained attached to the fuselage. However, 23 of the 26 passenger seats experienced structural failure. The crew seats were undamaged. The occupants experienced  $G_{\text{peak}}$  levels in the range of 31-67 g's with a pulse duration of 21-59 ms as measured in the pelvic region. This may be considered a severe impact which would have resulted in moderate to severe injuries to the occupants.

All exits remained operable after the impact. Nine of 23 external windows and 13 of 23 internal windows shattered.

The overhead fuel tanks broke loose from their mountings resulting in large quantities of fuel being spilled onto the occupants.

